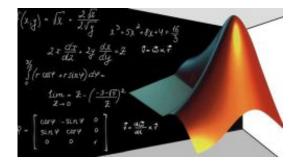
# **Informatics Practical Work**



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## Table of contents

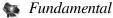
## I - Vectors in MATLAB

1. Introduction	
2. Objectives	
3. What is MATLAB?	
3.1. Programming environment	
4. Definition a vector	
5. Different methods to identify a vector	4
5.1. Random vector	4
5.2. Regular vector	5
6. Types of the vectors	6
6.1. Row vectors	
6.2. Column vectors	
7. Vector operations	7
7.1. Addition of vectors	7
7.2. Subtraction of vectors	
7.3. Multiplication of vectors	
7.4. Division of vectors	9
7.5. Power vectors	
7.6. Transpose of vector	
8. Other useful MATLAB functions	11
9. Acknowledgement and guide in the application by MATLAB	13
10. Exercice : Acquisition test - Chapter 1	
previation	15
liography	16
b bibliography	17

## **Vectors in MATLAB**



### 1. Introduction



**MATLAB** allows you to address elements or subsets of vector elements simply and efficiently. This is one of the important features of **MATLAB**.

### 2. Objectives

- Learn the way to define and/or declare row vector, as well as column vector
- Learn the basics to apply operations in two vectors (+, , x , and /)
- Learn additional commands that can help in vectors operation

### 3. What is MATLAB?

MATLAB is a **software package** designed for **mathematical** and **scientific computing**. It is also a **development environment** and a **programming language**. Its primary specialization is **efficiently handling matrix** and **vector** mathematics.

You can think of **MATLAB**<sup>\*</sup> as one of the **most useful programs** in the **engineering fields**. It deals with the **numbers** as a **matrices**, so, that is why the first part of its name is the **first three later** of the **matrix**, and the other part of its name is **LAP**, which is represents the short cut of **Laboratory**. It is designed to help you **manipulate very large sets** of **numbers quickly** and with **minimal programming**. **Operations** on **numbers** can be done **efficiently** by **storing them** as **matrices**. **MATLAB** is **particularly good** at doing **matrix operations** (this is the origin of its name).

#### 3.1. Programming environment

Fig 1 shows a version of the default MATLAB programming environment. It consists of four spaces:

- 1. The MATLAB Command Window with the MATLAB prompt sign,
- 2. The workspace displaying the variables in the MATLAB memory,
- 3. The current folder box showing the folder's content, and
- 4. The Command history box showing a list of recent commands.

Applications

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Image: State of the state o	(2) Workspace (memory)

Fig 1.1 Default layout of the MATLAB Programming Environment

#### 3.2. Applications

- Matrices calculations
- Programming
- Graphing (plotting of equations)
- Numerical analysis
- Automatic control
- Statistical analysis
- And so many applications

## 4. Definition a vector

#### 🥒 Definition

By default, a <sup>\*</sup>vector is a **one-dimensional array** of **numbers**. In other words, it is a **single row** with **several columns** or a **single column** with **several rows**.

## 5. Different methods to identify a vector

Before we identify a vector in MATLAB, we must know if the vector:

#### 5.1. Random vector

MATLAB allows you to create an <sup>\*</sup>arbitrary vector or called (**irregular**, **random**) vector in **three ways**, containing different numbers.

• Each element in the vector with the **order** 

• All the elements inside a square bracket and between each element and the other space

• All the elements inside a square bracket and between each element and the other comma ","

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Fig 1.2. Different methods to create a random vector

#### 5.2. Regular vector

MATLAB allows you to create a uniformly spaced vector called a proper (regular) vector in two ways.

- Using the function/command linspace(X1, X2, N); which generates N points between X1 and X2.
- Using the function/command v = [X1 : P : X2]; which generates v vector, with the first element X1, last element X2, and the difference between elements is any real number P.

#### 🦢 Example

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Fig 1.3. Two methods to create a regular vector

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#### 🔊 Note

If you **don't write** the **step** or call the **difference between** elements **P** value it will take P = 1 **automatically**.

### 6. Types of the vectors

MATLAB allows you to create two types of vectors which can be stored either:

- A\* row vectors and
- A \*column vectors.

#### 6.1. Row vectors

#### *Definition*

Are created and/or declared by enclosing the set of elements in square brackets, using space or comma "," to delimit the elements, which can have any number of elements. For example, there are two ways to create a row vector with five elements.

#### 👉 Example

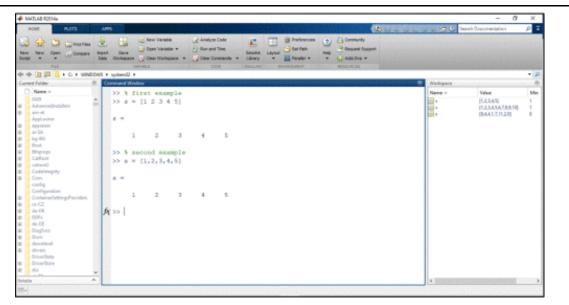


Fig 1.4. Two ways to create a row vectors

#### 6.2. Column vectors

#### 🥒 Definition

Are created and/or declared by enclosing the set of elements in square brackets, using a semicolon ";" to delimit the elements. For example, there is one way to create a column vector with five elements.

#### 🡉 Example

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Fig 1.5. Define a column vector

## 7. Vector operations

In this section, let us discuss the following vector operations-

- Addition and subtraction of vectors
- Multiplication of vector
- \*Division of vector
- \*Power of vector, and
- Transpose of vector

Besides the standard vector operations, MATLAB performs an element-by-element array operations ( addition, subtraction, multiplication, division, and power) among vectors of the same dimensions.

To illustrate this special feature, consider two vectors, A and B, of n=3 elements.

#### 7.1. Addition of vectors

You can **add two vectors**. Both the **operand vectors** must be the **same type** and have the **same number** of elements.



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Fig 1.6. The sum of two vectors A and B

#### 7.2. Subtraction of vectors

Is the difference between two given vectors, whose defined in MATLAB by the following way.

🁉 Example

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unrent Folder (K)	Conversant Window 8	Wedgate	
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Fig 1.7. The difference between two vectors, A and B

### 7.3. Multiplication of vectors

Is the **multiplying** of **two given vectors element-by-element**, whose defined in **MATLAB** by the following way.

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Fig 1.8. The multiplication of two vectors, A and B

#### 7.4. Division of vectors

Is the division of two given vectors element-by-element, whose defined in MATLAB by the following way

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👉 Example
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Fig 1.9. The division of two vectors, A and B

#### 7.5. Power vectors

Is the **power** of **two given vectors**, whose defined in **MATLAB** by the following way.



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Fig 1.10. The power of two vectors, A and B

#### 7.6. Transpose of vector

Is an operation that changes a row vector into a column vector, and vice-versa using the transpose commands or the apostrophe (\*).

#### 🦢 Example

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Fig 1.11. Transpose vectors with two different ways

🔊 Note

- In MATLAB, row and column numbers always begin with 1, not zeros, as in other programming languages. Zero, as it is the case in other programming languages.
- The **dimension** of the **two vectors must be the same** for the **operation in the vectors**, which means the **the number** of **elements** in **each vector must be the same/equal**.

10

- Here, operator.\*(dot multiplication), ./(dot division), and .^ (dot power) are used for element-byelement array operations. These operators make programming for computation compact and efficient.

## 8. Other useful MATLAB functions

For vectors, to find the **maximum** and **minimum** values of the vector **x**, we use the command/function **max(.)** and **min(.)** 

#### **Example**

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3         -15-CF           4         -05-CF           8         -06-CF           9         -06-CF           10         -06-CF           10         -06-CF           10         -06-CF	>> 6 find the max value >> max(x) ans = 11 fg >>   (d		

Fig 1.12. The minimum and maximum values from a vector x

To **find** the **summation** and the **production** values of the vector **x**, we use the command/function **sum(.)** and **prod(.)** 

6	Example
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Fig 1.13. The sum and the product of the element in a vector x

For vectors, to **sorts** the **elements** of a given vector **x** in **ascending order arrange without** or **with reputation** , we use the command/function **unique(.)** and **sort(.)** 



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Fig 1.14. Arranging the vector's value from smallest to largest with or without reputation

Again, to sorts the elements of a given vector  $\mathbf{x}$  in descending order, we use the command/function sort (.,'descend')

#### 🦢 Example

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am-et Applincher appraiser	x= 0 4 4 1 7 11 2 -5	
ar-5A hg-80 Sect Sthurode	>> sort(x, 'descend')	
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ContainerSettingsProviders cs-CZ de DK		
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Fig 1.15. Arranging the vector's value from largest to smallest

The mean of a vector, also known as the average equals the sum of the vector elements divided by the number of elements in the vector, we use the command/function mean(.)



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Fig 1.16. The mean of the vector x

#### 🔊 Note

You can get information about the dimension of a vector using command/function length(.)

*┟ Example* 

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Fig 1.17. The dimension of the vector x

## 9. Acknowledgement and guide in the application by MATLAB

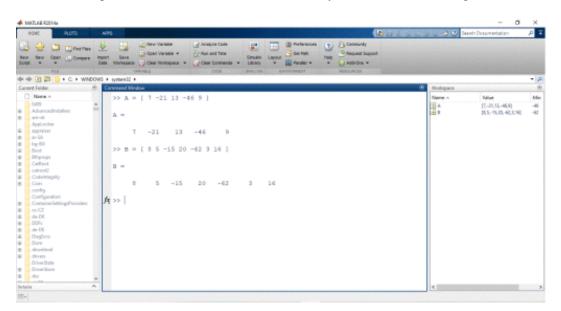
Complement:For more information about the practical application on vectors in MATLAB, you c access to the link of the video below

See "Vectors in MATLAB"

## 10. Exercice : Acquisition test - Chapter 1

Exercice : Assignment N°1

In MATLAB, is it possible to calculate the division element-by-element of the following two vectors ?



- □ Yes
- □ No

#### Exercice : Assignment N°2

What's the types of vectors?

- $\Box$  Row vectors
- □ Column vectors
- □ Row and column vectors
- □ Column and row vectors



## Abbreviation

MATLAB: MATrix LABoratory

## Bibliography

MATLAB A PRACTICAL INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING

MATLAB A SELF-TEACHING GUIDE

MATLAB for Beginners

## Web bibliography

https://www.tutorialspoint.com/matlab/matlab\_vectors.htm

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